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C Williams and J M Sparrow

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# Pragmatism versus purity: effectiveness of the key informant methodology in a developing rural setting

C Williams, J M Sparrow

The goal of the VISION2020 initiative is to eliminate avoidable blindness by the year 2020.<sup>1</sup> The estimated prevalence of blindness and visual impairment in 2002 was lower than previously predicted (37 million instead of 52 million), suggesting that the three components of VISION2020 – disease control, human resource development and infrastructure development, have successfully helped millions of people escape visual impairment or blindness.<sup>2</sup> However, the WHO point out that with an ageing population in many countries, the risk of visual impairment increases and therefore these early successes need to be developed and expanded to meet this challenge.

At the other end of the age range, an example of concrete progress in this worldwide effort is provided by Muhit *et al.* (see pages 995 and 1000) in this month's *BJO*. The authors describe a method to add to the existing techniques to ascertain blind children in a developing country. Whereas many valuable studies have used data from children in schools for the blind to estimate the proportion due to different causes, this paper illustrates that important additional information may be obtained by also including children identified by local members of the community, who have been briefed by the study team on what to look for. These individuals, known as "key informants" (KIs) were unpaid volunteers who, after attending a half-day training session, spent 2–3 weeks in their communities actively seeking out blind or visually impaired children and encouraging their families to bring them to the eye examination carried out by the project team.

The first point to note is that the number of children ascertained by the KIs was nearly double that of the

numbers recruited from special and integrated schools or community-based rehabilitation (CBR) programmes combined (1245, vs. 394 and 296, respectively). Second, the children recruited by the KIs were more likely to have severe visual impairment (SVI) rather than blindness; 9.8% SVI vs. 4.8% in blind schools and 7.8% in community programmes. Third, the cause of their vision loss was 40% more likely to be avoidable than for children identified in schools for the blind and, similarly, 30% more likely to be avoidable than for those identified in CBR programmes. Fourth, the children identified by the KIs were more likely to be female, aged 0–5 years, to live in rural areas and have infantile-onset eye problems, than children identified by the other two methods – groups which would otherwise have been under-represented.

The results described by Muhit *et al.* illustrate the value of this method in the search for accurate prevalence data, particularly for individuals who may benefit from treatment or who might have benefited from preventive strategies. Although this approach has limitations – for example, it is most suited to a society that is relatively open and in which people know others that are in their own geographic area, thereby being limited by transport rather than social convention – it is a valuable addition to existing techniques in population-based ophthalmological research. The "Gold Standard" of enumerating each person in households in geographically defined clusters and examining them all has been successfully used for common eye conditions in children,<sup>3</sup> but the large sample sizes needed for rare conditions (such as blindness in children) make formal population-based surveys prohibitively expensive and logistically challenging. Even

when identifying the population of interest from centralised databases and offering them transport to attend a central facility, it is difficult to achieve high enough compliance rates to provide accurate prevalence data and the databases may not include all individuals of interest. Thus, the use of KIs is a valuable addition to available methods for future studies on the prevalence of blindness and has the potential to make such studies more representative of the whole population. The additional cost of the KI component was only 25% of the whole study, therefore the additional 'cost per case identified' using the KI method was around a fifth of the 'cost per case identified' using traditional methodology. The marginal costs associated with the use of KIs were thus very small considering the large number of extra children identified, and the added value of these data to the statistical power and representativeness of the study as a whole. Compared with the cost of carrying out conventional population-based research in established market economies such as the UK, the value for money represented by this method is impressive and may have applications in developed as well as developing countries.

Without quality population-based data on prevalence and causes of vision loss, control strategies cannot be devised, nor their effectiveness assessed. Improved data acquisition by this approach will strengthen confidence when making judgements of effectiveness and guide future policies towards better blindness prevention programmes.

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## Authors' affiliations

C Williams, J M Sparrow, Bristol Eye Hospital, Lower Maudlin Street, Bristol BS1 2LX, UK

Correspondence to: Miss Cathy Williams, Bristol Eye Hospital, Lower Maudlin Street, Bristol BS1 2LX, UK; [cathy.williams@bristol.ac.uk](mailto:cathy.williams@bristol.ac.uk)

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Surgical treatment of peripapillary choroidal neovascularisation

# Surgical treatment of peripapillary choroidal neovascularisation

Susanne Binder

Surgical treatment of peripapillary choroidal neovascularisation is a valuable therapeutic option which should not be undertaken too late

Peripapillary choroidal neovascularisation (PPCNV) comprises about 10% of all cases of choroidal neovascularisation.<sup>1</sup> Starting at the nasal margin of the disc the condition does not become symptomatic until fluid, exudate, blood, or the membrane itself have extended from the disc toward the macula, threatening central vision. Very large PPCNVs are defined as more than 3.5 disc areas or greater in size and involve 180° or more of the disc circumference.<sup>2</sup> Although less common than smaller PPCNVs, the very large ones may lead to severe visual loss.<sup>3</sup> Over time, scar contraction at the edge of the PPCNV causes breaks in Bruch's membrane, and the associated haemorrhage leads to a new circle of "reparative" fibrovascular ingrowth that manifests as progression or extension of the PPCNV complex.<sup>1</sup>

PPCNVs can be idiopathic or secondary to various conditions. In a recent survey,<sup>4</sup> Browning and Fraser reported that PPCNV was associated with age related macular degeneration (AMD) in 45% of cases, while 39% were idiopathic, so at least 84% of the patients will be over the age of 55 years. Although the diagnosis of "idiopathic" PPCNV<sup>5</sup> is unsatisfactory, the presence of these lesions in clinically normal eyes has been demonstrated in pathological studies.<sup>6,7</sup> The remaining cases of PPCNV occur secondary to multifocal choroiditis, angioid streaks, histoplasmosis, choroidal osteoma, optic disc drusen, congenital disc anomaly, pattern dystrophy, and peripapillary pseudopodial pigment epithelium and choroidal atrophy.<sup>4</sup>

In patients over 70, involvement of the second eye in PPCNV can be expected in 20–62% of all cases.<sup>4,8</sup> At this age, 75% of untreated cases have lost visual acuity (VA) to a level of 3/60 or less. The time between the involvement of the first and the second eye varies from simultaneous to seven years.<sup>8</sup> On fluorescein angiography, PPCNV may contain a significant occult component, leading to slow and unpredictable growth; in fact more than half the AMD related and idiopathic cases

are entirely or mainly occult.<sup>9</sup> This makes PPCNVs difficult to treat by laser, which requires well defined lesion margins.

Results of laser photocoagulation for PPCNV vary. In 1988 Kies and Bird recommended that a large margin of normal tissue should be treated, and that there should be laser ablation of any angiographic abnormality around the lesion.<sup>3</sup> In their series of 55 cases, only 13 (23.6%) received laser treatment, and recurrences were observed in three quarters of these. Once the centre was affected by fluid, bleeding, or choroidal neovascularisation, VA did not recover or improve spontaneously. Flaxel *et al*<sup>2</sup> reported 1996 on their results with laser treatment for very large (massive) PPCNV, measuring 3.5 disc diameters or more, and with treatment limited to the temporal portion of the neovascular complexes. Six of 10 treated cases showed stabilisation while four progressed to severe visual loss. In PPCNV related to histoplasmosis, Turcotte *et al*<sup>10</sup> reported stable vision in about 75% of cases after laser treatment. On the other hand, no statistical difference in final VA following laser treatment for AMD-PPCNV was reported by Ruben *et al* in 1994.<sup>11</sup> In Browning and Fraser's survey,<sup>4</sup> 73 of 115 eyes with PPCNV of various origins underwent laser treatment; in 14 (19.2%) a recurrence was noted, and multiple recurrences occurred in four (5.5%). Comparable results with recurrence rates of 20% and 28% were reported by Annesley *et al*<sup>12</sup> and Cialdini *et al*.<sup>13</sup> Finally, in the Macular Photocoagulation Study PPCNV subgroup, there was no improvement in visual outcome with laser ablation over three years of untreated follow up; furthermore, there was no significant difference in the rates of severe vision loss between treated and untreated eyes.<sup>14</sup>

## WHAT ABOUT SURGICAL EXCISION FOR PPCNV?

Since Thomas and Kaplan introduced subretinal surgery for foveal choroidal neovascular membranes in 1991,<sup>15</sup> several

groups have reported on membrane excision for PPCNV.

Successful surgery with improvement in vision was described in two single case reports of the surgical removal of AMD related extrafoveal PPCNV, where fluid accumulation had caused visual loss.<sup>16,17</sup>

In 2003, Sullu *et al*<sup>18</sup> presented a case report of a nine year old girl with binocular PPCNV related to papillary drusen, who already had submacular involvement in her left eye. Wrongly diagnosed as having papilloedema, this child had undergone extensive neurological examination. After surgery the VA improved in the left eye from 0.05 to 0.3, and no recurrence was observed. In 1998, Atebara *et al* reported on 17 young patients with extensive PPCNV related to histoplasmosis.<sup>19</sup> In the majority (82%, 14/17), the PPCNV had already reached the fovea. While all cases with a preoperative extrafoveal location of the PPCNV reached a VA of 20/20 postoperatively, half the remaining 14 eyes achieved a final VA of 20/40 or better. After 32 months recurrences were observed in 24% (4/17). No surgical complications occurred. In 2004, Kertes described three patients aged 25–30 years with histoplasmosis and PPCNV, all of whom underwent surgery.<sup>20</sup> The location of the PPCNV extended extrafoveally in two and was juxtafoveal in the third. VA improved after surgery in all three eyes, two reaching 20/20 and the third, 20/50. Postoperatively, one peripheral tear needed laser treatment.

In 2003, Bains *et al* presented the surgical results in 17 patients over 55 years of age with extensive PPCNV, mainly AMD related or idiopathic.<sup>21</sup> Preoperatively the PPCNV was located extrafoveally in seven cases (41%) but 11 eyes (59%) already showed foveal extension. Visual acuity was stable or improved in six eyes (35.2%) and worsened in 11 (63.8%). After an observation period of 30 months the investigators concluded that surgical excision yielded improvement or stabilisation of VA in about one third of their elderly patients. Complications such as retinal detachment, macular oedema, and preretinal membrane formation were observed in five eyes (29%).

Eleven AMD patients with massive PPCNV not eligible for laser treatment or refusing it were included in a study by Blinder *et al* in 2005.<sup>22</sup> Cases where the PPCNV extended into the fovea were excluded, and the mean size of the membrane was 5 o'clock hours. After 23 months follow up seven cases (64%) had stable or improved VA, with a mean change of one line improvement. In three cases (27%), a recurrent membrane developed. In the same year, Kokame and

Yamaoka described the outcome of surgery in six elderly patients with extrafoveal PPCNV, where vision was threatened or affected by subretinal fluid, haemorrhage, exudate, or neovascular membrane growth.<sup>23</sup> After three years of follow up, VA was stable or had improved in five cases (83%) with a range of VA between 20/25 and 20/80. In three eyes there was early or late recurrence.

In this issue, Aisenbrey and coworkers report on the two-year functional and morphological outcome of subretinal membrane excision in eight patients with AMD related PPCNV (see page 1027).<sup>24</sup> Preoperatively, mean VA was logMAR 0.5; this improved to mean logMAR 0.3. Six of the eight cases gained vision. Although recent progression of the disease was the indication for surgery, in no case had the membrane extended into the fovea. Two years after surgery one recurrence was observed and was successfully removed surgically. The authors discuss newer treatment options, including photodynamic therapy, where a safety distance of 200 µm from the margin of the optic disc is recommended, and treatment with antiangiogenic agents. However, there is only one small case series on the successful treatment of PPCNV with photodynamic therapy, and none with antiangiogenic agents so far. Although small PPCNVs can be treated successfully with laser coagulation, the authors state correctly that large membranes may be ineligible for surgery because of the damage to the retinal pigment epithelium and the neurosensory retina that is caused by adhesions to the coagulated tissues. In agreement with the three recent reports cited above on the surgical excision of large PPCNVs, the authors recommend surgical intervention in older patients before the membrane has reached the centre of the fovea in order to maximise any improvement in vision.

Overall, younger patients with ocular histoplasmosis and other rare indications, with large, growing PPCNVs, have an excellent visual prognosis after subretinal surgery if the membrane is still extrafoveal. If the macula is already involved, there is a 50% chance of stabilisation or improvement, because the membrane in these cases tends to be located in the pre-pigment epithelium (type II),<sup>25</sup> and because the patients are younger and so some regrowth of pigment epithelium can be expected. Clearly, the decision to undertake surgery is easier if the fovea

is threatened or involved by fluid or exudates, and if the patient's vision is already compromised. In elderly patients, subretinal surgery to remove extrafoveal PPCNVs might also be a promising therapeutic option leading to visual improvement. However, little or no chance of regaining vision can be expected if the macula is already involved in the neovascularisation process.

Possible complications related to surgery include endophthalmitis, retinal detachment, and haemorrhage, but these are rare. Cataracts will develop in most of the elderly patients if the lens is not removed in combination with vitreous surgery. Over the past 15 years subretinal surgery has developed technically, and we have learned to keep the retinotomies small, to prevent haemorrhages, and remove subretinal tissue with minimal trauma,<sup>26</sup> making subretinal surgery for PPCNV a valuable therapeutic option which should not be performed too late!

There are, however, limitations to what we can conclude from the current studies because the numbers of cases are small and there have been no randomised comparisons with alternative treatments. Such studies are needed to define the place of surgery in the current therapeutic armamentarium. Other therapeutic options such as photodynamic therapy and antiangiogenic agents are being assessed, and there may be a place for combination therapies.

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Correspondence to: Professor Susanne Binder, Department of Ophthalmology, Rudolf Foundation Clinic, The Ludwig Boltzmann Institute for Retinology and Biomicroscopic Laser Surgery, Juchgasse 25, A 1030 Vienna, Austria; [susanne.binder@wienkav.at](mailto:susanne.binder@wienkav.at)

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Night vision disturbances after refractive surgery

## Night vision disturbances after refractive surgery: haloes are not just for angels

Stephen D Klyce

There has been considerable attention paid to the optical consequences of corneal refractive surgery, particularly those occurring during the night time when the pupil widens and larger areas of the sculpted cornea are included within the visual pathway. It seems a forgone conclusion that pupils larger than the functional optical zone (the area of the corneal surface after laser sculpting that provides quality vision<sup>1</sup>) created by the surgery should cause problems for the patient and, in truth, this has occurred with night vision complaints that include starburst effects and haloes. Therefore, it has been the strategy over the course of technique development for laser algorithms to sculpt ever larger corneal areas encompassing the full correction zone (the zone of intended refractive correction) and to incorporate cleverly designed surrounding transition zones to blend in curvature changes in a smoother fashion.<sup>1</sup> Taken together, these changes have reduced or eliminated many of the night vision complaints that were associated with pupil diameter, at least in some recent reports.<sup>2, 3</sup>

In this issue, Villa and associates (*see page 1031*),<sup>4</sup> have re-examined this problem in successful LASIK patients by using a commercial device to measure a night vision disturbance metric, the "halo disturbance index." They also measured the dark-adapted pupil size and the calculated optical aberrations arising from the corneal surface. In this careful study, the authors demonstrate that the halo disturbance index correlates strongly with specific aberrations: notably, spherical aberration, secondary astigmatism and coma. These aberrations, particularly spherical aberration and coma, are consistently reported in the literature as being the major culprits for the creation of visual disturbances following refractive surgery. However, in the current study, no correlation was found between the halo disturbance index and mesopic pupil diameter. This result is in contrast to the experience of many refractive surgeons, yet is consistent with findings published by some.<sup>2</sup> This finding is encouraging, since it suggests that laser algorithms are improving to the extent where at least some of the lasers being used can treat

patients with larger pupils without inducing night vision problems.

However, there is a caveat: the measurement of pupil diameter has been in standard use in refractive surgical screening procedures, and this should not be altered by the absence of statistically significant post-operative correlations being reported. Not only have these results been reported for an apparent minority of practices, but also, the absence of a correlation between two variables could mean that other variables confound or mask the effect. Simply, with the best of procedures and patient care, the occasional patient with large pupils will experience night vision complaints that are, rarely, debilitating. Still, the prudent course of action would be to evaluate the physical size of the functional optical zones<sup>1</sup> that can be created with a particular laser system at various amounts of correction and compare these with patient mesopic pupil size along with the maximum expected decentration. If the expected functional optical zone can be expected to overlay the mesopic pupil nearly completely, the chance for inducing night vision difficulties after surgery should be minimal. Note that night vision complaints also occur in a substantial number of unoperated patients, and psychometric documentation of these would be a useful adjunct to the patient evaluation routine.

The principle aim of Villa and colleagues<sup>4</sup> was to correlate corneal higher order aberrations with the halo phenomenon that occurs after what is currently accepted as successful refractive surgeries. Doing so should provide an objective measure of at least one of the forms of night vision disturbance. No psychometric evaluation was reported to determine any level of disability that the patients may have experienced. Rather, the authors used the Starlight device, which is said to measure the halo effect in patients. The Starlight instrument projects a central beam of light as a means to mimic gazing at a point light source under mesopic conditions. At intervals, near perception threshold peripheral point light sources are illuminated in serial fashion to obtain a visual field-like map of retinal sensitivity. When haloes are present, they will distort the peripheral test beams, so that

these will not be detected. The output is a map of targets seen. For the normal unoperated eye, corrected for refractive error, the Starlight device demarcates nearly all the total projected field; normal eyes do not experience significant haloes. For the refractive surgical eye, the device demarcates the region of the visual field over which the near-threshold stimuli were visualised. The peripheral area not seen by these eyes is added up to calculate the halo disturbance index.

While it is clear that haloes will distort light rays and potentially dim the spot produced on the retina below the detection threshold, it also seems likely that other optical effects would have a similar consequence. Disturbances experienced by refractive surgical patients include glare, haloes, starburst, hazy vision, monocular polyopia, simultaneous vision, and defocus. The underlying causes of these phenomena are generally attributed to corneal surface aberrations left behind after refractive surgery. Every one of these symptoms has the potential to reduce the spot intensity of light projected by the Starlight instrument. Hence, while the measurements are objective and meaningful, it is unlikely that they can be used to uniquely identify haloes as the source of visual distortion. It would seem more appropriate to regard the data from the Starlight instrument as a "light distortion index" rather than a "halo disturbance index."

Haloes are an optical phenomenon of nature and can be observed around the sun and stars as a consequence of light scatter caused by ice crystals or other substances in the atmosphere. In the eye, haloes have two main sources. One troublesome source from the past was the halo seen around bright lights particularly at night with hard, low-oxygen permeable contact lens wear. This produced Sattler's Veil, a diffraction phenomenon caused by epithelial edema.<sup>5</sup> There is the potential for haloes to be formed after surgery if periodic structures persist within the stroma, such as certain types of scar formation. A second type of halo effect in the eye is caused by refraction phenomena and is assumed to be due to the transition zone surrounding the treated area of the cornea. However, this type of halo is actually attributed to spherical aberration. While it is true that an abrupt transition zone can contribute to spherical aberration, it is the shape of the entire corneal region over the entrance pupil that contributes to spherical aberration. Hence, a very large treatment zone and a small pupil can still lead to haloes when there is significant residual ocular spherical aberration.

Despite these reservations regarding the interpretation of data from the

Starlight instrument, Villa and colleagues have provided means and data with which to examine success in refractive surgery in greater detail. Refraction, Snellen acuity, and contrast acuity are still the foundations for assessing refractive surgery, but to understand the causes of visual complaints remaining after treatment, we must look to the techniques Villa and colleagues have championed in their article.

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Correspondence to: Stephen D Klyce, PhD, LSU Eye Center, 2020 Gravier Street, Suite B, New Orleans, Louisiana 70112, USA; [sklyce@klyce.com](mailto:sklyce@klyce.com)

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